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Beef Cattle Finishing Supplements Today

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BEEF CATTLE FINISHING SUPPLEMENTS TODAY

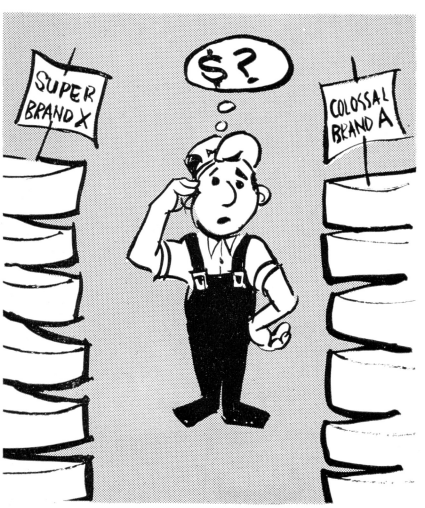
by Wise Burroughs

MANY KINDS and types of beef cattle supplements are on the market today. A choice often must be made by the cattle owner as to which one is superior and should be purchased.

Generally, one wishes to purchase a cattle supplement that results in maximum cattle performance in the feedlot. Fortunately, most beef supplements marketed today approach this characteristic, giving excellent feedlot performance. Therefore, the selection of the supplement hinges on other considerations such as cost per ton, cost per day, cost of gain, convenience in feeding, and continued availability.

The types of cattle supplements can, for convenience, be divided on the basis of their being liquid or dry and also the amount of urea they contain. Other classifications include physical form, such as large or small pellets, meal form, or protein blocks. Recently, premixes or superconcentrates have been appearing on the market which are too concentrated for safe feeding as a top dressing. These premixes, therefore, are mixed on the farm in the total ration with a feed wagon or mixed with the grain at the time the corn is ground, using a stationary or portable grinder-mixer.

In general, there is some trend toward the use of more concentrated beef supplements, due principally to expanded use of urea, coupled with greater mechanization in the feedlot for properly handling these feeds. The approximate ingredient composition of five protein supplements varying in urea content is given in Table 1.



It should not be inferred from Table 1 that the urea-free supplement developed about 1950 is not a top-quality supplement and is not available in 1967. Supplements of this type are available, and when employed in the feedlot usually give fairly good results.

Similarly, the "100 percent urea supplements" in use today are not necessarily the best type of beef supplements. These new type supplements may at times produce slightly inferior feedlot performance as compared to some of the earlier types. Table 1 only demonstrates the composition of several types of cattle supplements in common use today and illustrates their development in time with the general trend toward the feeding of higher levels of urea.

Before pointing out some merits and some shortcomings of these different supplements, let's consider the major desirable features which all supplements should possess. These are illustrated in Table 2.

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TABLE 1. Approximate percentage composition different type supplements.

Year developed	1950	1955	1960	Current Liquid	Current Iowa-80 Premix
Crude protein %	32% supp.	32% supp.	32% supp.	32% supp.	80% supp.
Protein equivalent from urea	(no urea)	(25%)	(50%)	(100%)	(100%)
Oilmeals, (Soy, CSM, Linseed)	63	50	20	None	None
Cereal or by-products feeds	..	5	36	..	33
Molasses and/or dehy. alfalfa	28	28	20	82	..
Minerals	6	9	13	6	32
Trace mineral premix	1	1	1	..	1
Vit. A premix (2M/lb.)	2	2	2	+	2
Stilbestrol premix	..	2	2	+	2
Urea	..	3	6	12	30
TOTAL	100	100	100	100	100

TABLE 2. Desirable features of all cattle supplements.

1. Promote rapid liveweight gains.
2. Produce top-quality beef carcasses.
3. Convert feed efficiently—minimum feed/unit gain.
4. Produce beef economically—least cost/unit gain.
5. Produce beef that command top prices at the market.
6. Obtain optimum profit from beef production.

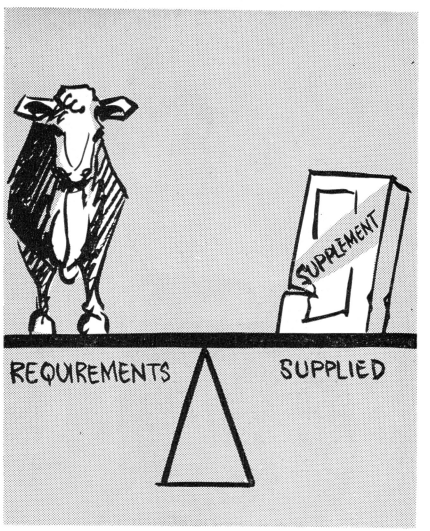


TABLE 3. Nutrient needs and other characteristics of beef finishing rations. (Values expressed in terms of air dry feed—90% D.M.)

Items	Range	Average
1. Daily feed consumption	2.0-3.0%	2.5% liveweight
2. Energy in ration	60-75 TDN 1200-1500 D.E.	65 TDN/lb. 1300 K cal/lb.
3. Minimum roughage	4-8%	6% fiber
4. Minimum protein	9-11%	10%
5. Calcium, minimum	0.25-0.35%	0.3%
6. Phosphorus, minimum	0.25-0.35%	0.3%
7. Minor minerals (cobalt, zinc, copper, manganese, iron)		Traces*
8. Vitamin A (International units true vitamin A/animal/day)		20,000 I.U.
9. Stilbestrol/animal/day		10 mg.
10. Unidentified factors expressed as lbs./animal/day of molasses, dehy. alfalfa or oil meals		0.5 lb.

* Traces such as those present in trace mineralized salt should be provided as insurance against deficiencies.

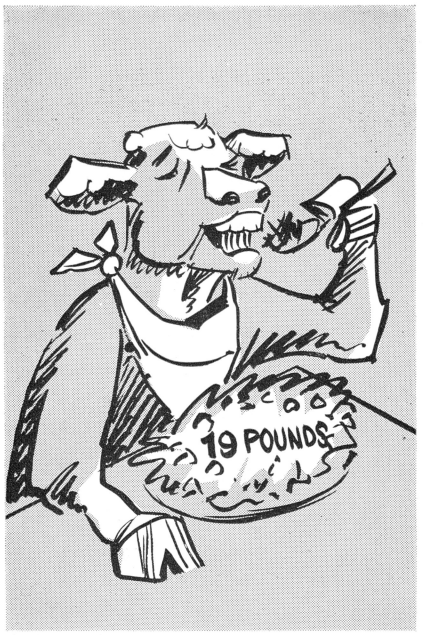
TABLE 4. Deficiencies in a ground ear corn finishing ration which need to be overcome with a suitable supplement. (Amounts expressed as needs of an 800-lb. animal/day.)

Items	Amount needed by animal	Amount supplied by ground ear corn	Inadequacies or supp. needs
1. Daily feed consumption	20 lbs.	19 lbs.	1 lb.
2. Energy in ration TDN	13 lbs.	14 lbs.	None
K cal D.E.	26,000	28,000	None
3. Minimal roughage (fiber)	1.2 lbs.	1.6 lbs.	None
4. Minimal calcium	0.06 lb.	Trace	0.06 lb.
5. Minimal protein	1.8 lbs.	1.4 lbs.	0.4 lb.
6. Minimal phosphorus	0.06 lb.	0.04 lb.	0.02 lb.
7. Minor minerals	Trace	..	Trace
8. Vitamin A (true)	20,000 I.U.	..	20,000 I.U.
9. Stilbestrol	10 mg.	..	10 mg.
10. Unidentified factors	0.5 lb.	..	0.5 lb.

These listed features are not only good characteristics of a cattle supplement, but apply to the total feedlot ration. This is not surprising since all cattle supplements should be designed to supplement the deficiencies or inadequacies of the energy or non-supplementary ingredients (grain, roughages, etc.) comprising the total ration.

To determine what nutrients and feed additives should be included in a supplement, first consider the deficiencies or inadequacies of each nutrient in the major feeds (grain and roughages) comprising the ration. This can be done most easily by the balance sheet method of comparing animal nutrient requirements with the amounts of nutrients supplied by the major feeds employed. The differences represent the quantities which the supplement should provide. Table 3 presents nutrient and other needs believed necessary for maximum cattle performance in the feedlot.

One typical Iowa ration for an 800-pound steer would be a full feed of ground ear corn and 1 pound of protein supplement. Such



a steer would be expected to consume 19 pounds daily. The nutrient pattern of this feed compared with the animal's needs are listed in balance sheet fashion in Table 4. The constituents which should be provided in supplemental feed when fed at rates of 2 pounds, 1 pound, or ½ pound per animal per day are listed in Table 5.

A second typical Iowa finishing ration for an 800-pound steer would be a full feed of corn silage, a light feed of corn grain and supplement. The deficiencies in such a ration if the animal consumed daily 45 pounds of silage (15 pounds air dry basis), 3 pounds of grain and 2 pounds of supplement are illustrated in Table 6.

About 2 pounds of a suitable beef supplement per day should be fed to meet the deficiencies of this corn silage ration. This should meet the energy requirements of the animal and produce maximum gains.

A portion of these energy requirements could, however, be met if the corn grain portion of this ration were increased 1 to 2 pounds daily above the 3-pound daily allowance as originally designated. By increasing the corn allowance by 1 pound to a total of 4 pounds per day, this ration could be adequately supplemented with as little as 1 pound of supplementary feed.

Similarly, if the corn allowance were increased by 2 pounds to a total of 5 pounds per animal per

TABLE 5. Suitable beef supplements for ground ear corn rations.

More important feed tag characteristics	2-lb. supp./ animal/ day	1-lb. supp./ animal/ day	½-lb. premix animal/ day
Minimum crude protein	20%	40%	80%
Minimum calcium	3%	6%	12%
Minimum phosphorus	1%	2%	4%
Trace minerals*	0.25%	0.5%	1%
Vitamin A, (I.U.)	20,000	20,000	20,000
Stilbestrol/lb. supp.	10 mg.	20 mg.	40 mg.
Unidentified factors	0-25%**	0-50%**	0-100%**

* Percent composition: Manganese 4.4, Iron 6.6, Copper 1.3, Cobalt 0.2, Iodine 0.3, Zinc 12.0, and Magnesium 20.0.

** Percentage of supplement composed of ingredients such as oil meals, dehydrated alfalfa or molasses.

TABLE 6. Deficiencies in a corn silage cattle finishing ration which need to be overcome with a suitable supplement.

Items	Amount Needed/ animal	Amt. in corn + silage	Inadequacies or supp. needs
1. Daily feed (air dry basis)	20 lbs.	16 lbs.	Up to 4 lbs.
2. Energy in ration TDN	13 lbs.	11.5 lbs.	1.5 lbs.
K cal D.E.	26,000	23,000	3,000
3. Minimum roughage (fiber)	1.2 lbs.	3.5 lbs.	None
4. Minimum protein	1.8 lbs.	1.2 lbs.	0.6 lb.
5. Minimum calcium	0.06 lb.	0.04 lb.	0.02 lb.
6. Minimum phosphorus	0.06 lb.	0.04 lb.	0.02 lb.
7. Trace minerals	Trace	..	Trace
8. Vitamin A (true)	20,000 I.U.	..	20,000 I.U.
9. Stilbestrol	10 mg.	..	
10. Unidentified factors	0.5 lb.	..	0.5 lb.*

* Supplied by such feeds as oil meal, dehydrated alfalfa or molasses.

TABLE 7. Suitable beef supplements for corn silage finishing rations.

More important feed tag characteristics	2-lb. supp./ animal/ day	1-lb. supp./ animal/ day	¾-lb. premix/ animal/ day
Minimum protein	30%	60%	80%
Minimum calcium	1%	2%	3%
Minimum phosphorus	1%	2%	3%
Trace minerals*	0.25%	0.5%	1%
Vitamin A (I.U.)	20,000	20,000	20,000
Stilbestrol/lb. supp.	10 mg.	20 mg.	40 mg.
Unidentified factors	0-25%**	0-50%**	0-75%**

* Percent composition: Maganese 4.4, Iron 6.6, Copper 1.3, Cobalt 0.2, Iodine 0.3, Zinc 12.0, and Magnesium 20.0.

** Percentage of supplement composed of ingredients such as oil meals, dehydrated alfalfa or molasses.

TABLE 8. Iowa economy supplement (27% "Urea Protein") of 1955.

Items	Per steer daily (lbs.)	Per ton (lbs.)	With dehy. cobs (percent)	Without* dehy. cobs (percent)
Dehy. corncob meal	.5750	1150	57.4	..
Molasses	.2000	400	20.0	47.0
Urea	.1000	200	10.0	23.6
Bone meal	.0375	75	3.8	8.8
Defl. Phos.	.0375	75	3.8	8.8
Limestone	.0375	75	3.8	8.8
Stilbestrol Premix	.0100	20	1.0	2.4
Trace mineral premix	.0025	5	0.2	0.6
TOTAL	1.0000	2000	100.0	100.0

* This mixture without dehydrated corncob meal contained 63% "Urea Protein." It was fed at the rate of 0.43 lbs./steer/day dispersed on 0.57 lb. of cob meal.

day, the supplementary allowance could be reduced to ¾ pound with a high-urea premix type. Such a supplement at times, however, will be inadequate in unidentified factors. Suitable supplements to be fed at varying rates with these high-silage finishing rations are illustrated in Table 7.

At Iowa State University, as little as ½ pound of Iowa-80 Premix daily has been successfully fed in high-silage rations where a minimum of 4 pounds of corn grain was fed daily to 500-pound calves throughout a 200-day or longer feeding period. This appears to be a slightly inadequate amount of protein based on a minimum of ¾ pound needed as illustrated in Table 7. But attempts to improve cattle performance in subsequent experiments by doubling the urea allowance in the Iowa-80 formula were unsuccessful.

This leads us to the question of "How good are these all-urea cattle supplements or premixes?" Four such mixtures are listed in Table 8, 9, 10 and 11. Two of these supplements were developed at Iowa State and two at Purdue University.

In general, these all-urea supplements have looked best in (1) high-grain finishing rations where (2) the cattle have been in the feedlot for a long period (4 months or longer) and (3) where the criteria of evaluation has been lower feed costs and net returns per entire feeding period.

Likewise, where these all-urea supplements have looked poorest is in (1) high-roughage rations where (2) the feeding period has been relatively short (100 days or less) and (3) where the criteria of evaluation has been rate of liveweight gain and rate of feed consumption.

The present cost of a unit of nitrogen in urea is less than 50 percent of the cost of a unit of nitrogen in natural feedstuffs, if no consideration is given to other nutrients in natural feedstuffs such as energy, vitamins and minerals. Even when these other nutrients are considered, urea nitrogen still remains economical.

The reason all-urea supplements usually compare more favorably in long vs. short feeding periods appears to be due to a physiological adjustment which cattle must undergo the first few weeks on such feeds. This was illustrated in an ISU experiment conducted in 1965 and summarized in Table 12. Compare cattle performance the first 6 weeks in the feedlot to the next feeding period of 154 days, and the total feeding period of 196 days.

Obviously, feed consumption and rate of liveweight gain in cattle re-

TABLE 9. Iowa-80 supplemental premix of 1965.

Items	Per steer daily (lbs.)	Per ton (lbs.)	With corn (percent)	Without corn* (percent)
Ground corn or molasses	0.165	660	33	..
Urea	0.150	600	30	44.8
Dicalcium phosphate	0.100	400	20	29.8
Limestone	0.060	240	12	17.9
Stilbestrol premix	0.010	40	2	3.0
Vitamin A premix	0.010	40	2	3.0
Trace mineral premix	0.005	20	1	1.5
TOTAL	0.500	2000	100	100.0

* This mixture without ground corn contained 115% "Urea Protein." It was fed at the rate of 0.33 lb./steer/day mixed with 0.17 lb. ground corn.

TABLE 10. Purdue 64 supplement of 1964.

Items	Per steer daily	Per ton	% with dehy. alfalfa	% without dehy. alfalfa*
Dehy. alfalfa meal	.500	1000	50.0	..
Molasses	.140	280	14.0	28.0
Urea	.211	422	21.1	42.2
Bone meal	.104	208	10.4	20.8
Stilbestrol premix	.010	20	1.0	2.0
Salt, vit. A + T.M.	.035	70	3.5	7.0
TOTAL	1.000	2000	100.0	100.0

* This mixture without dehydrated alfalfa meal contained 128% "Urea Protein." It was fed at the rate of 0.50 lb./steer/day mixed with 0.50 lb. of dehydrated alfalfa meal.

TABLE 11. Purdue 96 supplement of 1966.

Items	Per steer daily	Per ton	% with dehy. alfalfa	% without dehy. alfalfa*
Dehy. alfalfa meal	.197	592	29.4	..
Molasses	.094	280	14.0	19.9
Urea	.230	694	34.7	49.3
Bone meal	.104	310	15.5	22.0
Stilbestrol premix	.010	20	1.2	1.4
Salt, vit. A + T.M.	.035	104	5.2	7.4
TOTAL	0.670	2000	100.0	100.0

* This mixture without dehydrated alfalfa meal contained 129% "Urea Protein." It was fed at the rate of 0.47 lb./steer/day mixed with 0.2 lb. of dehydrated alfalfa meal.

TABLE 12. Unfavorableness of all-urea supplements largely due to initial 6-weeks adjustment of cattle to this type of supplement.

	Initial 6 weeks		Next 154 days		Entire 196 days	
18 steers/group	All-urea supp.	SBOM supp.	All-urea supp.	SBOM supp.	All-urea supp.	SBOM supp.
Initial liveweight, lbs.	495	488	573	588	495	488
Final liveweight, lbs.	573	588	999	1019	999	1019
Av. daily gain, lbs.	1.87	2.39	2.77	2.80	2.57	2.71
Feed/steer/day, lbs.	11.9	12.4	20.2	20.4	18.4	18.7
Feed/100 lbs. gain, lbs.	636	519	729	729	716	690
Feed cost/lb. gain	11.9c	11.3c	15.0c	16.1c	14.7c	15.8c

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ceiving the all-urea supplement were inferior the first 6 weeks for cattle on feed, compared to cattle receiving a supplement composed of SBOM or natural protein. During the next 154 days the cattle on both supplements performed very similarly. If the feeding period had been terminated shortly after the beginning 42-day period or even after 100 days, the urea supplement would not have compared nearly as favorably as it did at the end of the entire 196-day period.

What is responsible for the adjustment period? This we do not fully understand at present, but it is a fertile field for research. It may be merely a question of initial unfavorable palatability of the all-urea supplements.

Purdue University scientists recently suggested adding 3.5 percent salt to high-urea supplements to improve palatability.

The physiological factor involved in this initial adjustment may involve rumen fermentation rather than or in addition to palatability. At the Iowa experiment station, different levels of urea and sulfur additions to all-urea supplements have been fed. No benefits have been found by feeding more than 0.15 pounds of urea per animal per day in these all-urea supplements (Table 13).

Sulfur additions to these all-urea supplements improve urea utilization for about a 3-month period, but are without benefit or even injurious after this period if fed at levels higher than 0.015 pound of flowers of sulfur per animal per day. The adjustment which cattle undergo in utilizing all-urea supplements might, therefore, require an adaptation of rumen microorganisms in synthesizing sulfur amino acids. But research is needed to determine this.

TABLE 13. 1965 Iowa experiment with different levels of urea.[1]

Supplemental protein level supplied by urea. Urea per day.....	50% Iowa-80 (0.75 lb.)	100% Iowa-80 (.150 lb.)	150% Iowa-80 (.225 lb.)	200% Iowa-80 (.300 lb.)
Initial liveweight, lbs.	497	493	497	495
Final liveweight, lbs.	983	995	997	999
Av. daily gain, lbs.	2.47	2.56	2.55	2.57
Feed/steer/day, lbs.	17.9	18.6	18.3	18.5
Feed/100 lbs. gain	727	724	713	717
Feed cost/lb. gain	14.7c	14.7c	14.5c	14.7c

[1] 18 steers/group fed 196 days.

Quantity of Urea Supplied by Some "All-Urea Protein" Supplements

Iowa Economy of 1955	0.10 lb./steer/day
Iowa-80 Premix of 1965	0.15 lb./steer/day
Purdue 64 supplement of 1964	0.21 lb./steer/day
Purdue 96 supplement of 1966	0.23 lb./steer/day

TABLE 14. Estimating benefits from active supplemental constituents in typical Iowa finishing rations.

Active suppl. component	Amount fed/steer for 150 days	Cost/steer[1] 150 days	Extra gain	Total return	Return/$ invested
1. Protein	22.5 lbs.	$1.35	18 lbs.	$ 4.32	$ 3.20
2. Stilbestrol	1.5 lbs. premix	$0.35	37.5 lbs.	$ 9.00	$25.72
3. Minerals	24.75 lbs.	$1.26	10.5 lbs.	$ 2.52	$ 2.00
4. Vitamin A	1.5 lbs. premix	$0.36	3 lbs.	$ 0.72	$ 2.00
5. Unidentified factors	24.75 lbs. molasses	$1.18	6 lbs.	$ 1.44	$ 1.22
TOTAL in supp.	75 lbs. @ 6c lb.	$4.50	75 lbs.	$18.00	$ 4.00

[1] Estimated on basis of Iowa-80 premix.

Cattle feeders should consider the relative merits of different active components usually present in supplemental feeds here in Iowa and the Midwest. These active components can be appraised according to relative economic return basis by dividing them into five categories, namely: (1) protein, (2) feed additives, (3) minerals, (4) vitamin A and (5) unidentified factors (Table 14).

This estimate is subject to considerable error and can be made only crudely because of insufficient observations. Feed additives, such as antibiotics and others, were not included in the list of active supplemental constituents because responses to these materials are not uniformly positive under many cattle feeding conditions. Low-level antibiotic feeding often times is looked upon with greatest favor in larger feedlots, possibly due to greater stress conditions with heavier cattle concentrations.